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13. ABSTRACT Describes a method for evaluation of printing equipment operational and performance characteristics. Identifies supporting tests, facilities, and equipment required. Provides procedures for paper capacity, feed, registration, reproduction accuracy, turntable trueness, functional performance, controls, and indicators. Applicable to printing presses, printing machines, dry developing machines, electrostatic printers, and lithographic plate coating machines. Reproduced by NATIONAL TECHNICAL INFORMATION SERVICE Springfield, Va. 22151			

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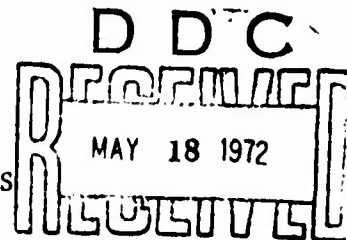
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Printing Press

U.S. ARMY TEST AND EVALUATION COMMAND
SYSTEM ENGINEERING TEST OPERATIONS PROCEDURES



AMSTE-RP-702-109

*Test Operations Procedure 10-2-124

14 January 1972

PRINTING EQUIPMENT

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SECTION I
GENERAL

1. Purpose and Scope. This TOP describes test procedures for evaluating the operational and performance characteristics of printing equipment. Equipment covered includes: printing presses, printing and dry developing machines, electrostatic printers and lithographic plate-coating machines. From the tests listed in Section II, the test director can select those that will satisfy the requirements for the particular test item and the particular test type (i.e., engineering test, initial production test, etc.). This document provides for simulated environmental testing but does not include service testing or environmental testing at climatic test sites.

2. Background. The most widely used method of recording and transferring information is by the use of printed documents. Because of

*This TOP supersedes MTPs 9-2-150 (13 Nov 1967), 10-2-122 (17 Apr 1968), 10-2-123 (26 Feb 1969) and 10-2-136 (11 Jul 69), including all changes.

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its standardization, size and mission the U.S. Army requires printing equipment capable of producing material of various grades quickly and efficiently. Printing equipment consists of:

- a. Printing presses--Type and illustration images are transferred to paper stock by means of printing ink. The unprinted stock is positioned by the press for receiving the impression which is made by transferring the ink from the image carrier to the stock. The printed paper is then ejected from the press.
- b. Photographic printers--When certain chemical emulsions are exposed to light a chemical reaction takes place, changing the areas exposed to a different compound. When a developer is applied to the emulsion a positive image is produced recording the various intensities of the exposing light. Some of the photographic printing methods are Vandyke, Diazo and the well known blue print process.
- c. Electrostatic printers--A dry printing process which utilizes electrostatic effects as its principle of operation. Light is passed through or reflected from the document to be copied to an electrically charged surface. The surface becomes discharged according to the intensity of light incident upon it. Charged particles are then brushed upon the surface and held by the oppositely charged areas on the surface, thus reproducing the original image upon it. The copied image is then fixed by heating or other means.
- d. Lithographic plate-coating machines--A device for uniformly applying a light-sensitive coating to a metallic plate. This plate is exposed by contact with a negative, developed and etched rendering the exposed areas of the plate receptive to ink for printing.

3. Equipment and Facilities. In addition to the equipment and facilities defined in the documents listed in Section II, a Lithographic Technical Foundation sensitivity guide is required to perform the procedures defined by paragraph 9.

SECTION II TEST PROCEDURES

4. Supporting Tests. Common Engineering MTPs/TOPs, Military Standards, the tests defined in Section III, and other published documents to be considered in formulating an engineering test plan are as follows:

<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
a. Pre-operational Inspection	10-3-500
(1) Operator Training and Familiarization	10-2-501

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	<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
(2)	Photographic Coverage	7-3-519
(3)	Interchangeability	MIL-P-55133A Para 4.7
b.	Physical Characteristics	10-2-500
c.	Safety	10-2-508
d.	Performance Tests	
(1)	Printing Press	
(a)	Lithographic	MIL-P-11058B Para 4.5
(b)	Letterpress	MIL-P-43288A Para 4.4 1
(2)	Printing and Dry Developing Machines	MIL-P-55133A Paras 4.6, 4.8, 4.10, 4.11, 4.14, 4.15
(3)	Electrostatic Printers	
(a)	Paper Capacity and Feed (Refer to para 5)	
(b)	Registration (Refer to para 6)	
(c)	Reproduction Accuracy (Refer to para 7)	
(4)	Lithographic Plate Coating Machine	
(a)	Turntable Trueness (Refer to para 8)	
(b)	Performance (Refer to para 9)	
(5)	Controls and Indicators (Refer to para 10)	
e.	Environmental Testing	
(1)	Temperature	MIL-STD-810B, Method 501 & 502, AR 70-38
(2)	Moisture Resistance (Printing and Dry Developing Machine)	MIL-P-55133A Para 4.9
(3)	Humidity	4-2-820
(4)	Fungus	4-2-818
(5)	Vibration	4-2-804
(6)	Rough Handling	4-2-602
(7)	Electromagnetic Interference Characteristics	MIL-STD-461A Notice 4 MIL-STD-462 Notice 3 Methods CE04, CE05, RE02

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<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
f. Transportability	
(1) Road, Rail, Marine	10-2-503
(2) Air	7-2-515
g. Human Factors Evaluation	10-2-505
h. Reliability	MIL-STD-781B Para 5
i. Durability	10-2-502
j. Maintenance Evaluation	10-2-507
k. Value Analysis	USAMC SUPPL 1 to AR 11-26

SECTION III SUPPLEMENTARY INSTRUCTIONS

5. Paper Capacity and Feed.

a. Objective. To determine the capacity of the feed bin and the capability of the feed mechanism to provide uninterrupted feeding of paper stock.

b. Method. Initially, the test item is adjusted for the minimum size of paper stock and loaded to rated capacity. The test item is set for the maximum number of copies and operated until feeding stops or the feed bin is empty. This test is repeated for the full range of paper stock applicable to the test item.

c. Data Required.

- (1) Nomenclature and type of test item.
- (2) Sizes and full load quantities of paper stock used.
- (3) Record of interruptions to feeding, stock jamming and any gripper nicks or other paper markings noted.
- (4) Residual quantities of paper stock remaining in feed bin upon completion of feeding operation.

d. Analytical Plan. The paper capacity of feed for the test item is determined by subtracting the residual quantities remaining, when

paper stock will no longer feed, from the total quantity of paper stock measured at full load. This capacity and any record of interruption to feeding, stock jamming or evidences of gripper nicks or paper markings are compared with the requirements and limitations stated in the MN to determine conformance to specifications.

6. Registration.

a. Objective. To determine that the reproduced copies provided by the test item duplicate all the dimensional characteristics of the original.

b. Method. An original document, prepared on the same size stock as loaded in the feeder bin, is alined with the appropriate etched markings on the test item easel. The test item control is set to provide 25 copies and then placed in operation. Each of the reproduced documents is then alined individually with the original, using a light table, to determine any dimensional or registration errors. These procedures are repeated for all applicable sizes of paper stock.

c. Data Required.

(1) Dimensions of original and reproduction paper stock.

(2) Recorded errors in dimensions and registration noted between original and reproduction when alined.

d. Analytical Plan. The recorded errors in dimensions and registration are tabulated and compared to the requirements and limitations stated in the MN to determine conformance with specifications.

7. Reproduction Accuracy.

a. Objective. To determine the accuracy with which the test item reproduces copy.

b. Method. An original is prepared consisting of accurately dimensioned geometric figures and grids. The original is placed on the test item and several copies are reproduced. The dimensions of the reproduced geometric figures are measured and recorded.

c. Data Required. Dimensions of the geometric figures and grids as measured on the original and reproduced copies.

d. Analytical Plan. The measured dimensions are tabulated and compared to determine amount of reproduction error. This error is compared with the limits stated in the MN to determine conformance to specifications.

8. Turntable Trueness.

a. Objective. To determine the turntable flatness of the test item and its capability to operate in one plane of revolution.

b. Method. The turntable is prepared for testing by drawing circles at one-third and two-thirds of the radius and drawing straight lines for every 30 degrees of arc from the center to the edge. A convenient external reference point is selected perpendicular to the surface of the turntable at the edge. Measurements are made from the reference point to the turntable edge and the two circles as each line, denoting 30° of arc, becomes perpendicular to the reference point. The turntable is rotated one complete revolution. This procedure is repeated as often as required to provide confidence in the validity of the measurements.

c. Data Required. Measurements obtained from the reference point to the edge and the two circles of radius for each 30° of arc from 30° to 360°.

d. Analytical Plan. The variation of the turntable from the true plane is determined as follows:

(1) The variance is computed by subtracting the minimum measurement from the maximum measurement for each radius.

(2) Each variance is divided by the average measurement from the reference point to applicable radius and the result multiplied by 100 to determine the percent of variation. This resultant variation from the true plane is compared to the requirements stated in the MN to determine conformance to specification .

9. Functional Performance.

a. Objective. To determine the capability of the test item to produce suitable plate coatings.

b. Method. Plate coatings are prepared using the test item. LTF Sensitivity Guides (see appendix) are positioned at the center and corner of each prepared plate. The plate is then exposed and processed. The highest sensitivity number visible at the center and corner of each plate is recorded.

c. Data Required.

(1) Procedure used for coating plate.

(2) Type of plate coating.

(3) Exposure and processing procedures used.

(4) Highest sensitivity number at each location on plate.

d. Analytical Plan. The thickness of the plate coating is determined by the sensitivity number. This coating thickness is compared with the requirements stated in the MN to determine conformance with specifications.

10. Controls and Indicators.

a. Objective. To determine the adequacy and accuracy of test item switches, controls and indicators.

b. Method. All test item switches and controls are placed in the OFF or MINIMUM position. The test item is then placed in operation by energizing switches and controls in the sequence directed by the manual of operating instructions. As each switch is energized, observations are made for indication of proper action. Variable controls (linear and nonlinear) are adjusted through their range of action and measured for rate of change. Indicators associated with these controls are observed to ensure that indications correspond accurately with the degree of control change. As controls are adjusted through their complete range of action, the effect on the test item is measured to determine response to control movement.

c. Data Required.

(1) Nomenclature and type of switch, control or indicator (electrical, electromechanical, mechanical).

(2) Test item response to switch or control operation.

(3) Indicator response to control movement.

(4) Rate of change measurements for linear and nonlinear controls.

(5) Timing measurements of delays and timers.

d. Analytical Plan. The recorded information is summarized, analyzed and compared with the requirements of the MN to determine conformance to specifications.

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Recommended changes to this publication should be forwarded to Commanding General, U.S. Army Test and Evaluation Command, ATTN: AMSTE-ME Aberdeen Proving Ground, Maryland 21005. Technical information related to this publication may be obtained from the preparing activity, Commanding Officer, Aberdeen Proving Ground, ATTN: STEAP-MT-DM, Aberdeen Proving Ground, Maryland 21005. Additional copies of this document are available from the Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. This document is identified by the accession number (AD No.) printed on the first page.

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APPENDIX
REFERENCES

1. AR 70-38, "Research, Development, Test, and Evaluation of Materiel for Extreme Climatic Conditions."
2. USAMC Supplement 1 to AR 11-26, "Value Engineering."
3. MIL-STD-461A, "Electromagnetic Interference Characteristics, Requirements for Equipment", including notices 1 thru 4.
4. MIL-STD-462, "Electromagnetic Interference Characteristics, Measurement of", including notices 1 thru 3.
5. MIL-STD-781B, "Reliability Tests: Exponential Distribution", including change 1.
6. MIL-STD-810B "Environmental Test Methods"
7. MIL-P-11058B, "Printing Press, Offset (Lithographic, Motor Driven, Mobile, 22-1/2 by 30 Inch Maximum Sheet Size)."
8. MIL-P-43288A, "Printing Press, Letterpress, Cylindrical Press, Vertical Press."
9. MIL-P-55133A, "Printing and Dry Developing Machine ES-30."
10. Lithographic Technical Foundation Ballistics:
 - (a) N.215, "Sensitivity Guide."
 - (b) N.502, "Offset Platemaking (Surface)."
 - (c) N.504, "Offset Platemaking (Deep Etch Gum Process)."